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Anatomical Study of Morphology of Acromion Process of Scapula and Its Correlation with Subacromial Impingement Syndrome

Dr. Anju Bala
Assistant Professor,
Pt. B. D. Sharma PGIMS, Rohtak, Haryana

Dr. Arvind Deswa
Associate Professor,
Rama Medical College, Hapur, UP

Dr. Ashok Sagar
Professor
& Head, Santosh Medical College, Ghaziabad, UP

Corresponding Author
Dr. Arvind
Deswal
Assistant Professor,
Rama Medical College & Research Centre, Hapur, UP, India

Abstract

The acromion process plays a critical role in maintaining shoulder biomechanics and is closely associated with the development of Subacromial Impingement Syndrome (SIS) due to alterations in subacromial space and rotator cuff compression (4, 2025). Understanding its morphological variations is essential for clinicians, as acromial shape directly influences the likelihood of mechanical irritation to the supraspinatus tendon and subacromial bursa (12, 2025). This study investigates the morphology of the acromion process in dry human scapulae and evaluates its correlation with Subacromial Impingement Syndrome (SIS), emphasizing the relevance of Bigliani's classification system in diagnosing and managing shoulder pathologies (6, 2025). A total of 80 dry scapulae were examined and classified into four types: Type I (flat), Type II (curved), Type III (hooked), and Type IV (convex), enabling a detailed assessment of morphological distribution. Type II acromion was found to be the most prevalent, followed by Type I, while Type III was the least common, consistent with clinical findings associating hooked morphology with increased risk of Subacromial Impingement Syndrome (SIS) (9, 2025). The morphometric variations in acromial shape significantly impact tendon wear, degenerative changes, and shoulder mobility (3, 2025). The findings of this study highlight the importance of anatomical knowledge in orthopedic diagnostics, preventive measures, and surgical planning, especially in rotator cuff repair and acromioplasty (7, 2025). Identifying patients with a high-risk acromion morphology may help in early intervention, reducing the burden of chronic shoulder pain and disability commonly associated with Subacromial Impingement Syndrome (SIS) (5, 2025). The study reinforces that understanding acromial variations enhances clinical decision-making and contributes to improved patient outcomes. These anatomical insights are valuable for anatomists, anthropologists, clinicians, and surgeons who routinely deal with shoulder disorders and surgical reconstruction in cases of severe impingement (14, 2025).

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Introduction

The **acromion process**, a prominent projection of the scapula, forms the highest point of the shoulder and plays a vital role in stabilizing the **glenohumeral joint** by serving as an attachment site for key ligaments and muscles including the deltoid and the trapezius (3, 2025). Its shape and orientation significantly affect the biomechanics of the shoulder and have been strongly correlated with **Subacromial Impingement Syndrome (SIS)**, a common clinical condition characterized by painful entrapment of rotator cuff tendons under the coracoacromial arch (5, 2025). The morphological differences in the acromion influence the amount of available subacromial space, and reduction of this space predisposes individuals to rotator cuff degeneration, inflammation, tendon tears, and chronic shoulder pain (11, 2025).

Understanding these variations is essential not only for diagnosing impingement but also for preventing misinterpretation during radiological evaluation.

The prevalence of shoulder impingement syndrome has increased due to lifestyle changes, sports participation, and occupational overuse injuries. Anatomical and biomechanical factors such as acromial shape remain significant intrinsic contributors, emphasizing the importance of detailed morphological studies (8, 2025).

Cadaveric studies provide critical insights into skeletal morphology that are not influenced by soft tissue distortion or age-related fatty infiltration, making them invaluable for understanding the structural features of the acromion (2, 2025). Moreover, orthopedic surgeons rely on accurate knowledge of acromial morphology during procedures like acromioplasty, arthroscopic decompression, and rotator cuff repair to avoid iatrogenic damage and optimize functional outcomes (10, 2025).

Given the clinical and biomechanical significance of the acromion, the present study aims to evaluate the morphological features of the acromion process using dry scapulae and assess their correlation with Subacromial Impingement Syndrome (SIS). (14, 2025).

Materials and Methods

The present anatomical study was conducted on **80 dry, fully ossified human scapulae** obtained from the Department of Anatomy, Pt. B. D. Sharma PGIMS, Rohtak. All specimens were adult scapulae with fully developed ossification centers, free from any visible deformities, fractures, or pathological alterations (4, 2025). Each scapula was carefully examined to assess the morphology of the acromion process. The acromion was observed from superior, inferior, lateral, and posterior views to determine its three-dimensional shape accurately. Classification was done according to **Bigliani et al.**, which includes four types: Type I (flat), Type II (curved), Type III (hooked), and Type IV (convex) (12, 2025). Special emphasis was placed on differentiating Type II and Type III acromia due to their clinical relevance in Subacromial Impingement Syndrome (SIS).

To maintain measurement accuracy, each specimen was placed in a standardized orientation. Morphological characteristics such as acromial curvature, inclination, and anterior overhang were evaluated visually and recorded (15, 2025).

The hooked configuration of Type III acromion was given special attention due to its well-documented association with rotator cuff degeneration (10, 2025).

Data were tabulated and subjected to descriptive statistical analysis. The frequency and percentage distribution of each type were calculated manually and cross-verified.

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The analysis aimed to determine the prevalence of each acromion type and evaluate the potential risk of SIS based on morphological characteristics (6, 2025).

Results

The findings of the present study demonstrate considerable morphological variation in the **acromion process** of the scapula among the 80 specimens examined (2, 2025). According to Bigliani's classification, **Type II acromion** was the most prevalent morphology, identified in **59%** of scapulae, indicating its dominance in the studied population (11, 2025). **Type I (flat) acromion** was observed in **36%** of samples, while **Type III (hooked)**—the morphology most strongly associated with **Subacromial Impingement Syndrome (SIS)**—was present in only **5%** of the specimens (12, 2025). No specimen displayed Type IV acromion.

The higher prevalence of Type II morphology suggests a moderate curvature pattern in the population, consistent with previous anatomical studies indicating that curved acromion is the most common form globally (14, 2025). The lower frequency of Type III acromion may indicate a lower predisposition toward rotator cuff degeneration and Subacromial Impingement Syndrome (SIS) among this population.

The observations highlight the relationship between acromial morphology and potential shoulder pathology, especially regarding the risk associated with hooked acromion (Type III). These results provide valuable data for orthopedic clinicians and anatomists studying variations in scapular morphology.

Discussion

The present study underscores the clinical relevance of acromial morphology, showing that **Type II acromion** predominates, while the **Type III hooked acromion**, strongly linked to SIS, is relatively rare (14, 2025). This suggests a lower inherent risk for impingement within the studied population. Acromial variations significantly influence rotator cuff biomechanics, subacromial space, and tendon wear patterns (4, 2025). Understanding these morphological differences assists clinicians in diagnosing Subacromial Impingement Syndrome (SIS), planning acromioplasty, and forecasting patient outcomes (10, 2025). Morphological studies such as this enhance orthopedic knowledge and improve preventive and therapeutic approaches.

Summary

This anatomical study of 80 dry scapulae revealed that **Type II (curved)** acromion was the most common morphology, followed by Type I, whereas Type III was the least common (11, 2025). Since the Type III acromion is strongly associated with **Subacromial Impingement Syndrome**, its low prevalence suggests comparatively reduced risk of impingement-related rotator cuff pathology in this population (8, 2025). The study provides essential anatomical insights for clinicians, anatomists, and orthopedic surgeons, aiding in the diagnosis and management of shoulder disorders (6,

2025). These findings contribute to better understanding of acromial variations and their clinical implications.

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